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## ABSTRACT

Presented is an abstract of a study done to try to determine a set of variables which are capable of accounting for a significant amount of variation in algebra achievement in each of two instructional formats. Tables representing final grade distributions, initial comparison of groups, and comparability of volunteer subgroup variables are included. Some degree of association between certain variables is indicated; however, it is noted that the major hypotheses remain to be tested. (MK)

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An Investigation of Selected Intellective and  
Non-Intellective Variables and Their Use in  
Predicting Success in Two Instructional Formats  
of a College Algebra Course

A Paper Presented at The  
1979 Annual Meeting  
of

The Southwest Education Research Association

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## ABSTRACT

The existence of individual differences is indisputable. The range of human performance and capability on innumerable dimensions is well documented in both popular and professional literature, and one encounters many specific examples daily. The present study argues that individual differences are important in instructional formats, that learning characteristics of subpopulations can be isolated which facilitate and enhance learning among technical and engineering student populations.

The case for alternate instructional formats is premised on the assumption that adult learners vary on several dimensions which can be operationalized as variables within instructional settings. This study attempts to show that when achievement or success within a specified course is used as the dependent variable, adult sub-populations with differing profiles of defining attributes respond differentially in their achievement of the success criterion.

The problem addressed by this study involves the identification of a set of variables which is capable of accounting for a significant amount of variance in algebra achievement in each of two instructional formats, a self-paced computer-assisted instructional format and a traditional lecture-demonstration instructional format.

There have been numerous studies comparing the efficiency of alternative instructional formats, with no evidence consistently showing one instructional format better than others in promoting student performance. A frequent and valid criticism of many comparison studies revolves around the disproportionate amount of time devoted to the experimental and control groups; essentially comparing the best possible experimental method against the average lecture method. However, if it is accepted that people do learn differently, then it is obvious that some instructional formats will be better for some people than

for others.

Although a few studies have attempted to profile the learning variables which relate to success in one instructional format, such a profile for differentiating successful from unsuccessful students across instructional formats is needed. Such a profile would allow learners to be matched to an instructional format to optimize their chance of success.

The present study was conducted on the basic algebra course Basic Technical Mathematics (TMT 135) at the College of Technology, University of Houston. There were thirteen sections of TMT 135, six sections were self-paced and seven sections were lecture-demonstration, with enrollment of approximately 200 and 175 respectively. Students were free to register for whichever sections they wished. No attempts were made to manipulate or control the instructional settings. The classes were taught under normal conditions with their own instructors. The content in all sections was equivalent with the exception that the self-paced sections had in-class access to several supplementary texts and the computer in addition to the required text (Basic Technical Mathematics, A.J. Washington, 1978).

The criterion variable was success in the course, measured by an achievement test covering material through the first two-thirds of the course, which permitted a greater number of self-paced students to complete all of the course material required by the test questions. A multiple regression model was used, with instructional method as a dummy-coded variable. The prediction equation included the variables of arithmetic achievement, verbal reasoning, study habits and attitudes and attitudes toward mathematics. Data on other variables such as rationale for enrollment, sex, age, and employment status were also collected.

The data, collected during the Fall semester 1978, is currently being analyzed. Descriptions and comparability of the two subpopulations along each variable are presented in the accompanying tables.

Table 1 shows the distribution of final grades within each of the two instructional formats. The lecture sections use the standard grading sequence A, B, C, D, F, with an occasional "I" given for special circumstances. The self-paced sections use the grading sequence A, B, C, I, W, where "I" is assigned to students who have made satisfactory progress through at least two-thirds of the material and "W" is assigned to students who have not completed at least two-thirds of the course.

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INSERT TABLE 1 ABOUT HERE

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An "F" is given in the self-paced sections for students who have excessive absences and unsatisfactory progress. A grade of "W" is also assigned automatically in both sections to students who withdraw from the course by their own volition.

Table 2 shows the initial means and standard deviations of the two instructional formats on each of the independent variables. The two groups are not apparently

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INSERT TABLE 2 ABOUT HERE

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different from each other at the time of enrollment, suggesting that differences in achievement are probably not due to selective enrollment. Students who enroll in self-paced courses do not differ from students who enroll in lecture courses with respect to verbal reasoning ability, numerical ability, study habits, study attitudes, mathematics enjoyment, or mathematics anxiety.

The numbers of students who took each test varies because the tests were administered on different days. The Differential Aptitude Test (DAT) subtests Verbal Reasoning (VR) and Numerical Ability (NA) were administered on a voluntary basis to comply with the guidelines for the protection of human subjects. The other instruments were administered under departmental authorization, and were considered part of the course. It was necessary to assume that those who volunteered

to take the DAT were not different from those who did not volunteer. To test this assumption, we examined the predictor variables and selected demographic variables. The 37 non-volunteers, 318 volunteers, and 119 absentees were not found to be different. Table 3 shows the final grade distribution for each of the three categories, while Table 4 shows the means and standard deviations on the independent variables. There were no significant differences between the ~~two~~<sup>whole</sup> groups.

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INSERT TABLES 3 AND 4 ABOUT HERE

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There was no significant degree of association between volunteer status and college of major, sex, marital status, or military experience. There was some degree of association (Chi-square significant at .05) with class level, age and employment. Non-volunteers and those who were absent tended to be upper classmen, older, and employed while attending school. No other measure of association (Cramer's V and Lambda) suggested that the subgroups were truly different. Therefore, it was concluded that the volunteers for this study were typical of the population as a whole.

The major hypotheses remain to be tested at this time. The question being asked is whether the predictor variables account for a significant amount of the variance in algebra achievement in each of the instructional formats, and whether the weights assigned to each predictor variable are significantly different across instructional formats.

TABLE 1

Final Grade Distribution by  
INSTRUCTIONAL FORMAT

| Count<br>(Column %) | LECTURE      | SELF-PACED   | TOTAL        |
|---------------------|--------------|--------------|--------------|
| GRADE               |              |              |              |
| A                   | 36<br>(16.2) | 34<br>(13.5) | 70<br>(14.8) |
| B                   | 45<br>(20.3) | 39<br>(15.5) | 84<br>(17.7) |
| C                   | 45<br>(20.3) | 46<br>(18.3) | 91<br>(19.2) |
| D                   | 30<br>(13.5) | 1<br>(0.4)   | 31<br>(6.5)  |
| F                   | 34<br>(15.3) | 7<br>(2.8)   | 41<br>(8.6)  |
| I                   | 8<br>(3.6)   | 51<br>(20.2) | 59<br>(12.4) |
| W                   | 24<br>(10.8) | 74<br>(29.4) | 98<br>(20.7) |
|                     | 222          | 252          | 474          |

T A B L E 2  
INITIAL COMPARABILITY OF SUB-POPULATIONS  
VARIABLES

| Mean<br>Std. Dev.<br>(Count) | Verbal<br>Reasoning      | Numerical<br>Ability     | Study<br>Habit            | Study<br>Attitudes        | Math<br>Enjoyment         | Math<br>Anxiety           |
|------------------------------|--------------------------|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Lecture                      | 35.755<br>9.556<br>(143) | 27.385<br>6.276<br>(143) | 47.957<br>17.254<br>(161) | 58.081<br>14.539<br>(161) | 37.825<br>11.205<br>(160) | 35.181<br>10.472<br>(160) |
| Self-Paced                   | 35.457<br>9.936<br>(175) | 28.040<br>6.428<br>(175) | 49.115<br>17.890<br>(192) | 57.573<br>15.123<br>(192) | 39.555<br>11.090<br>(209) | 36.493<br>9.498<br>(209)  |

TABLE 3  
FINAL GRADE DISTRIBUTION BY  
VOLUNTEER STATUS

| Count<br>(Column %) | NON-VOLUNTEERS | VOLUNTEERS   | ABSENTEES    | TOTAL        |
|---------------------|----------------|--------------|--------------|--------------|
| GRADE               |                |              |              |              |
| A                   | 4<br>(10.8)    | 53<br>(16.7) | 13<br>(10.9) | 70<br>(14.8) |
| B                   | 11<br>(29.7)   | 60<br>(18.9) | 13<br>(15.5) | 84<br>(17.7) |
| C                   | 4<br>(10.8)    | 77<br>(24.2) | 10<br>( 8.4) | 91<br>(19.2) |
| D                   | 0<br>( 0.0)    | 24<br>( 7.5) | 7<br>( 5.9)  | 31<br>( 6.5) |
| F                   | 2<br>( 5.4)    | 19<br>( 6.0) | 20<br>(16.8) | 41<br>( 8.6) |
| I                   | 6<br>(16.2)    | 47<br>(14.8) | 6<br>( 5.0)  | 59<br>(12.4) |
| W                   | 10<br>(27.0)   | 38<br>(11.9) | 50<br>(42.0) | 98<br>(20.7) |
|                     | 37             | 318          | 119          | 474          |

T A B L E 4

COMPARABILITY OF VOLUNTEER SUBGROUPS  
VARIABLES

| Mean<br>Std. Dev.<br>(Count) | Verbal<br>Reasoning      | Numerical<br>Ability     | Study<br>Habit            | Study<br>Attitudes        | Math<br>Enjoyment         | Math<br>Anxiety           |
|------------------------------|--------------------------|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Volunteers                   | 35.591<br>9.753<br>(318) | 27.745<br>6.358<br>(318) | 48.921<br>17.229<br>(242) | 57.880<br>14.844<br>(242) | 39.708<br>10.713<br>(257) | 36.568<br>9.555<br>(257)  |
| Non-Volunteers               |                          |                          | 53.143<br>16.772<br>( 28) | 61.393<br>13.315<br>( 28) | 37.417<br>11.336<br>( 28) | 36.000<br>9.064<br>( 28)  |
| Absentees                    |                          |                          | 46.440<br>18.869<br>( 84) | 56.667<br>15.408<br>( 84) | 37.200<br>12.153<br>( 85) | 34.141<br>10.911<br>( 85) |
| Population                   |                          |                          | 48.667<br>17.627<br>(354) | 57.870<br>14.871<br>(354) | 38.981<br>11.130<br>(370) | 35.968<br>9.873<br>(370)  |